WC-TPC Match

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15 August 2016

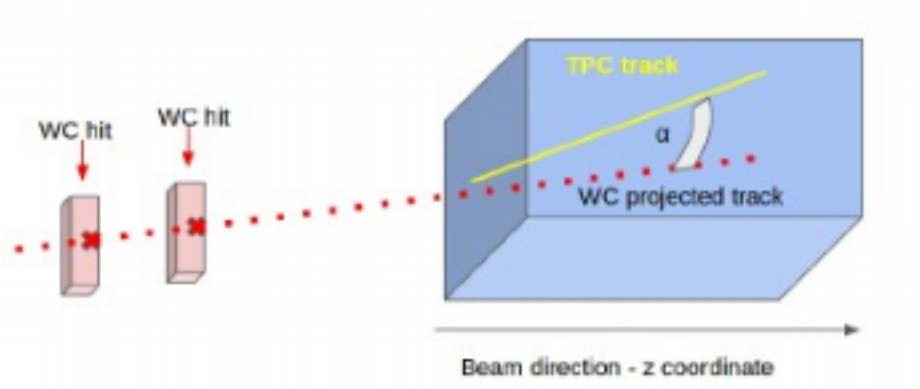
Goal of understanding the WC-TPC matching algorithm

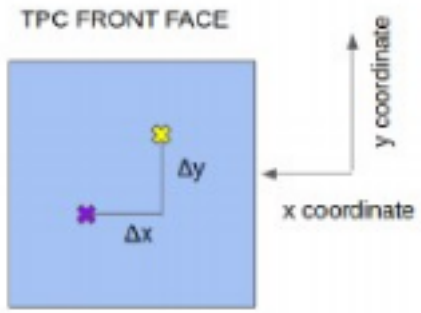
Investigate the asymmetry in difference in x-position of WC-Track end point and TPC-Track start point.

Current algorithm:

1) Project WC-Track to front face of the TPC
2) For each TPC track with spacepoints within 2cm of the TPC face, find a Delta X, Delta Y, and Alpha between the TPC track and WC-Track
3) Cut based on these values according to:

-2 cm < DeltaX < 6 cm -3 cm < DeltaY < 6 cm Alpha < 20°





WC-TPC Match

An Unambiguous Sample

To test our matching performance, created an unambiguous sample where each event has one WC-Track, one TOF, and one entering TPC track.

These strict requirements make it so that the entering TPC track must have originated from the WC track, an unambiguous match.

Used protons from Run II as they do not create showers and are a completely orthogonal set from both the pion and kaon analyses.

Cut Scheme:

1) Single TOF and WC Object
2) Reco. mass between 800 and 1200 MeV/c^2
3) Only one TPC track in first 14 cm of the TPC
4) Only one TPC track with spacepoints below 2 cm

Samweb definition: WCTPC_wide_dsmith
defname: Lovely1 and data_tier digits
secondary.polarity positive
run_number > 8000 and run_number < 9000

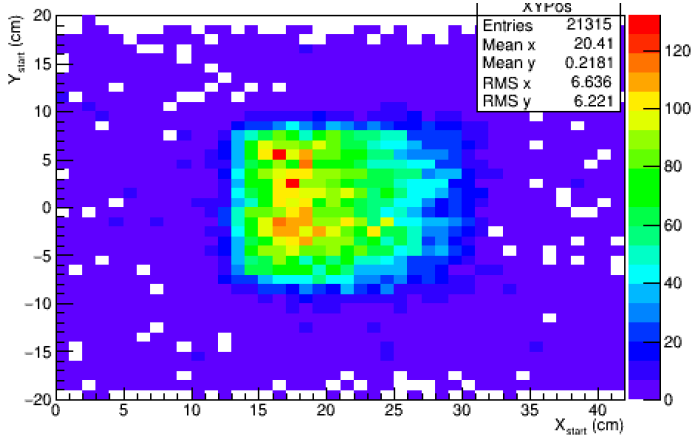
Reduction Table	
Cut	Events
Sliced	~800000 *
TOF & WC Object	234717
Mass	80309
One Track < 14 cm	52926
One Track < 2 cm	21315

* approximated using 20 events / spill

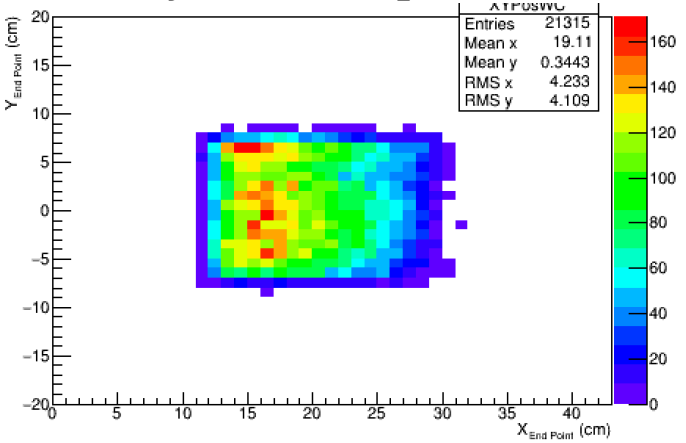
WC-TPC Match

Verification Plots

Pos. of first TPC spacepoint

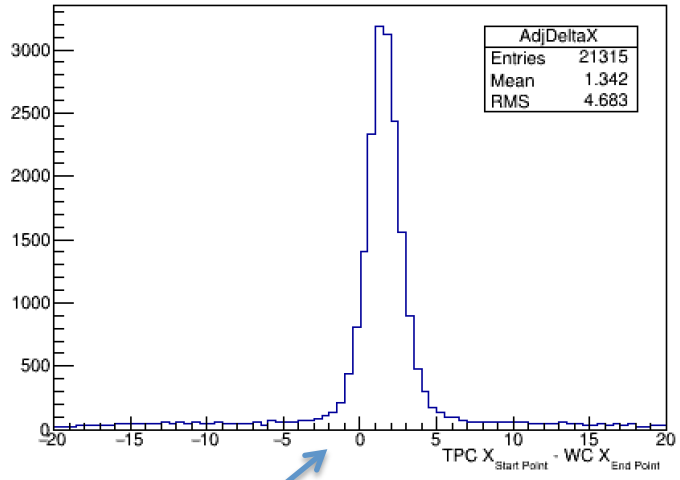


Projected WC position

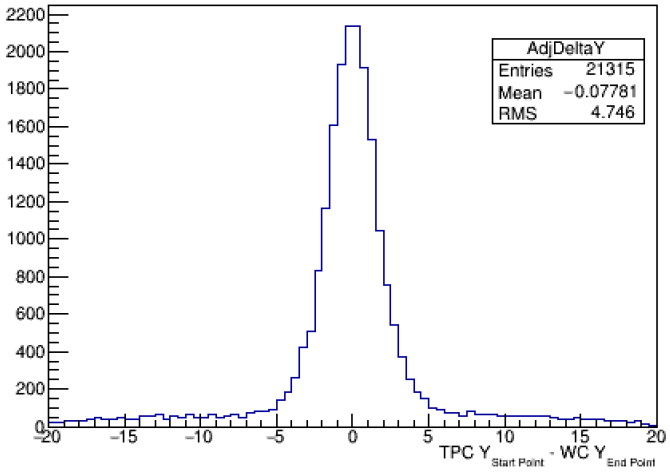


Square shape created by the shape of the MWPC.

TPC X_start – WC X_proj



TPC Y_start – WC Y_proj



Delta X is not symmetric around 0.0 cm, but around 1.34 cm

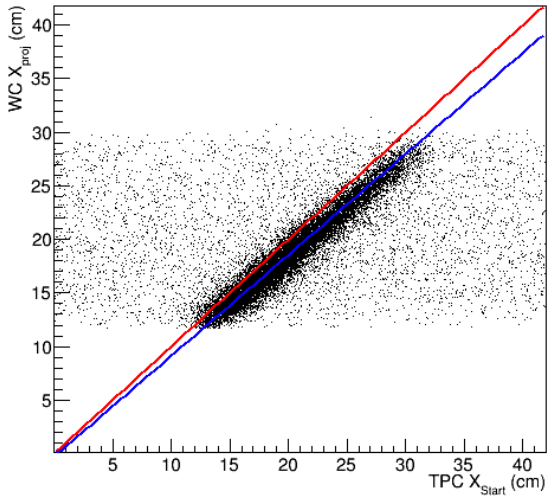
WC-TPC Match

Investigate Asymmetry

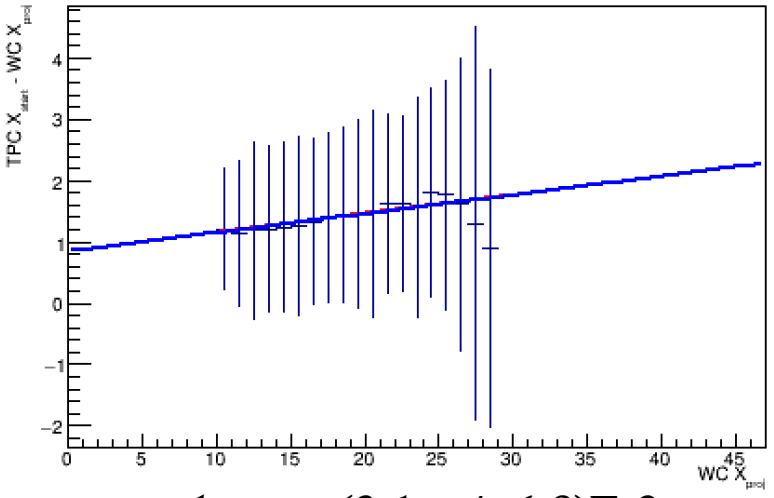
First suspicion of cause is error in Electron Drift Velocity

TPC X reco. relies on the drift velocity of electrons. Since electrons have a constant velocity in the TPC, time and electron drift velocity can be used to reconstruct x position.

An error in drift velocity measurement results in a scalar error in the reco. x position. This error manifests itself as an linear increase of TPC X - WC X as a function of distance from the TPC wires, instead of the expected zero value.



slope = 0.92 +/- 0.07



slope = (3.1 +/- 6.9)E-2

If electron velocity measurement was perfect, WC X vs. TPC X should have a slope of 1 and TPC X – WC X vs. WC X should have a slope of zero.

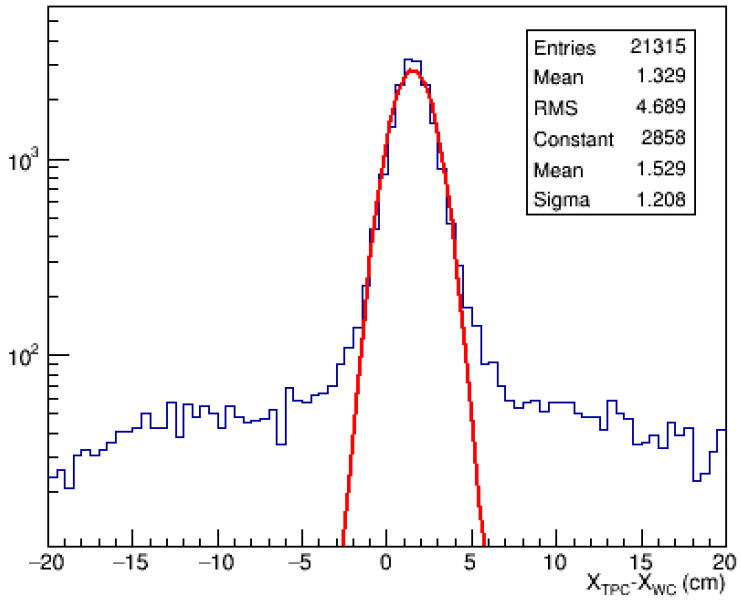
Both slopes are, however, within error bars of their correct values.

WC-TPC Match

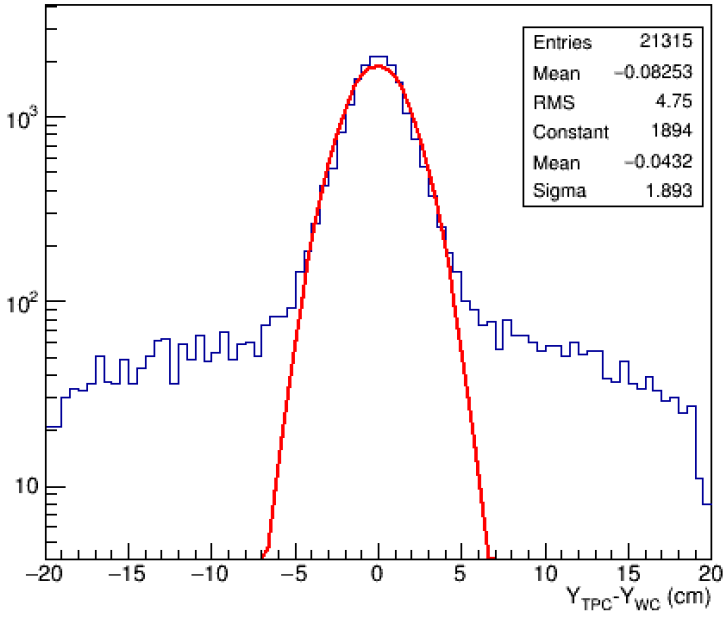
Summary

Investigation did not lead to a definitive answer.

Best to live with the asymmetry, using new cut values.
Values represent 2.5-sigma range on Gaussian fit.



-1.49 cm < Δ X < 4.55 cm



| Δ Y | < 4.73 cm